

*The Integration of Functions of a Single Variable.* Cambridge Tracts in Mathematics and Mathematical Physics, No. 2. By G. H. Hardy, M.A. Pp. viii+53. (Cambridge: University Press, 1905.) Price 2s. 6d. net.

Now that function-theory is fairly well developed, it is much easier than it used to be to discuss in an orderly way the elementary problems of explicit integration. By showing how this can be done, Mr. Hardy has produced a very instructive and pleasant supplement to the ordinary text-books. Moreover, he has done a useful service by emphasising the work of Liouville, whose theorem (quoted on p. 49) is of great generality, and occurs with others in memoirs which have not, perhaps, received all the attention they deserve. To these memoirs, as well as those of Abel, Tchebichef, &c., reference is made in the notes and appendix; this, of course, adds greatly to the value of the pamphlet.

It must be remembered that the "Cambridge Tracts," of which this is No. 2, are not intended to be exhaustive, but rather suggestive and helpful to those who are really interested in the progress of mathematical theory, and prepared to study it at first hand. Mr. Hardy seems to have carried out this idea as well as his opportunity admitted; and his reader ought to feel that he gets his half-crown's worth of entertainment. For example, on pp. 13-16 we have Hermite's beautiful way of finding, by elementary rational operations, the rational part of the integral of a rational function, and in connection with this an example involving, in an unexpected fashion, the theory of invariants. To the remark on p. 38 it may be added that the problem of deciding whether a given integral is pseudo-elliptic or not is likely to be of a nature quite similar to that of deciding whether two given conics can be associated with poristic circum-inscribed polygons. No finite number of rational operations can give an answer; but we can decide whether poristic polygons of any assigned number of sides exist or not. To the references on this subject the names of Halphen and Kowalevsky might have been added.

*The Laboratory Book of Dairy Analysis.* By H. Droop Richmond, F.I.C. Pp. viii+90. (London: C. Griffin and Co., Ltd., 1905.) Price 2s. 6d. net.

WITH the progress of technical instruction in dairying a need has arisen for a little handbook on milk composition and simple methods of milk analysis for dairy managers. There is also a need for a short handbook of dairy analysis for the trained chemists who find themselves called upon to undertake analyses of milk, cream, butter, and cheese in the laboratories of agricultural colleges and institutions. Mr. Richmond has attempted to serve both purposes in one little volume, and, as might be expected, the result is not entirely successful. For the chemist the illustrations of laboratory assistants performing simple laboratory operations, such as using a wash-bottle, are, to say the least, unnecessary, while to the dairy manager who is not a chemist the directions for the more difficult analyses would be quite unintelligible.

However, for the chemist the book provides a mass of useful details in a concise form. The analytical methods are well chosen, though it is curious to find no mention of the Westphal balance for the determination of the specific gravity of milk; and we can detect no errors or inaccuracies, though there is occasional need for greater clearness, for example, in the meaning of "the Reichert-Wollny figure." These defects are unimportant, and the book will find a useful place in many an agricultural laboratory.

T. S. D.

## LETTERS TO THE EDITOR.

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### Chemistry in Rural Schools.

It has no doubt caused as much surprise to others as it has to myself to read, on the authority of the principal of the South-Eastern Agricultural College, that "chemistry is one of the least suitable of the natural sciences to teach children whose lives will be, or ought to be, spent in the country" (M. J. R. Dunstan, NATURE, March 29, p. 511). I have no doubt that Mr. Dunstan has good reasons to assign for this expression of opinion, but those who are interested in the subject of education in rural schools will probably want some more explicit statement before reconsidering their curricula. For my own part I had come to an opposite conclusion. It has been my privilege during the last few years to have been associated with the founders of two rural schools, one in Essex and the other in Sutherland. The curricula of these schools were very carefully considered by my colleagues and myself, and the question of the suitability of chemistry was never raised; on the contrary, we considered that from the disciplinary as well as from the utilitarian point of view it had everything in its favour. Nor have we had any reason during the existence of these schools to doubt the wisdom of including chemistry in the curricula. As a means of training in experimental method and of inculcating habits of careful observation and accurate reasoning, this science (with physics) has been taught with the greatest success. It is popular with the pupils and of distinct value to them in after life, even when that life is "spent in the country."

Perhaps the best justification I can offer for the conclusion to which my own experience has led me is furnished by the Sutherland Technical School, founded three years ago at Golspie by the Duchess of Sutherland. The pupils in this school are as "rural" a set of lads as could be gathered from any part of the Highlands, being for the most part of the crofter and fishing class. Their age varies from twelve and a half years upwards, and the course of instruction extends over a period of three years. During the first year four hours a week are given to elementary practical physics, and the same amount of time to practical chemistry during the second year. Both physics and chemistry will be continued in the third year. The headmaster, Mr. E. W. Read, writes to me as follows:—"The boys like the work, and find no particular difficulty with it; besides, I find their knowledge a great help in the natural history lessons and in the gardening. Further, I feel strongly that the mental discipline of chemistry properly taught is very great, and is likely to put a boy's mind in the attitude of desiring to keep pace with the progress of the times. Most of our boys will have to go straight to work, and I should be very sorry if a single one left without some knowledge of elementary chemistry."

We have had a similar experience in Essex, and it would be of interest to learn from others who have first-hand knowledge of the teaching of science in rural schools of a similar type to those founded by the Countess of Warwick and the Duchess of Sutherland how far chemistry has been successful as a recognised part of the curriculum. It would appear from Mr. Dunstan's letter that he considers this science to have been inserted in the curricula at the expense of the biological sciences. This is not the case in the two schools with which I am concerned. Natural history subjects (in the broad sense) are also taught, and one of the reasons which weighed with us in including chemistry was that an elementary training in this subject was considered essential as a preliminary foundation for the biological subjects. With respect to the education of young men who are actually "on the land" or who are preparing for rural occupations, the teaching of chemistry at the Central School of the Essex County Council at Chelmsford has always been most successful, both in popularity and in subsequent results. The former staff instructor, Mr. T. S. Dymond, now of the Board of Education, to whose zeal and ability the successful intro-

duction of chemistry among the Essex farmers and horticulturists is largely due, could no doubt furnish some interesting information on this subject. At any rate, it was by the close observation of Mr. Dymond's work during the period of my connection with the Essex Technical Instruction Committee that I was most strongly convinced of the suitability of chemistry as a subject for secondary rural schools.

Mr. Dunstan may, however, not include the work being done at the Chelmsford central school within the range of his criticism, as the pupils there catered for are certainly beyond the age of those attending the other two schools dealt with in this letter. In defending the claims of chemistry as a suitable subject—not dogmatically, for I am quite open to arguments against my view—it is hardly necessary to say that the most liberal interpretation of the definition of the term is asked for, and that my advocacy presupposes that the subject is properly, *i.e.* scientifically, taught. I am quite aware that distinguished authorities like Prof. Clifford Allbutt and Sir William Ramsay have expressed views similar to those of Mr. Dunstan. That makes it all the more necessary, however, to raise the whole question and have it authoritatively handled in the interests of rural education.

R. MELDOLA.

April 5.

### Carnivorous Habits of the New Zealand Kea Parrot.

In your issue of December 28, 1905, there occurs a note referring to statements made at a meeting of the Philosophical Institute of Wellington with regard to the habits of *Nestor notabilis*, to the effect that the carnivorous habits that have been attributed to this parrot are exaggerated, if not totally untrue. It is unfortunate that this report of the meeting has obtained the wide currency that NATURE will give it, for it is abundantly evident that the speakers at Wellington were unacquainted with the facts about the kea.

In the course of various trips about the South Island of New Zealand during the last five or six years, I have made inquiries from shepherds and others likely to know about the kea as to how far their own personal acquaintance with this bird tallied with the common statements that they attack sheep. I was surprised to find that, in North Canterbury and in Marlborough, these men doubted the truth of these statements. They had never known the kea attack sheep in these districts. I was, consequently, inclined to take the view just put forward by the members of the Wellington Institute. I then wrote a series of identical letters to run-holders, shepherds, and others who were supposed to have had experience in this matter in Otago, with the result that overwhelming evidence of the existence of this habit was presented to me. Possibly the "naturalists and estate agents" of the Wellington Institute had not tapped the right district; that they gave their opinion in good faith I do not for a moment doubt.

It must be borne in mind that the kea is confined to the high mountainous country of the South (or Middle) Island, and does not occur in the North Island. It lives in the rough mountain tops in Alpine districts, and it is in this high, rough country that the damage to sheep has occurred, as Sir W. Buller has pretty fully described in his monograph on the "Birds of New Zealand."

It was in the Wanaka district, in Otago, that the greatest amount of damage was done in the early days of sheep-farming, and it was to managers of stations, to shepherds, musterers, and "kea shooters" employed on some of these stations that my inquiries were directed.

Several of these run-holders lost sheep by thousands, and reckoned their losses from kea attacks by thousands of pounds; some were practically ruined by the kea and the rabbit combined.

They engaged men specially to shoot and otherwise destroy keas; the county councils gave 1s. to 2s. 6d. a head for the birds; the squatters and Government also paid for beaks. Is it probable that these people would expend hundreds, nay, thousands, of pounds on a chimera?

Let me quote one or two extracts from letters received by me from men who have seen the kea attacking sheep, who have seen the sheep coming in at muster with holes in their sides and the entrails hanging therefrom, and

on shearing have noted the wounds on the skin. These men, I may say, are well known in the district, and I have taken every care to apply only to those whose word may be relied on to give their own personal experience. These letters I hope to publish in full in the Transactions of the New Zealand Institute next year, so that their personal experiences in the early days of sheep-farming may be preserved.

Mr. Fraser, now stock inspector in Nelson province, writes:—"I was engaged sheep-farming in the Hawea and Wanaka lake districts in 1871-1883. I lost thousands of sheep from keas. I have seen the kea attacking the sheep, and also eating into a sheep when the latter was stuck in deep snow. I have opened scores of kea crops and found wool and meat therein. I have laid poison in dead sheep in snow, gone back later and found dead keas."

It was at Mr. Henry Campbell's station near Lake Wanaka, Otago, that these injuries to sheep were first (in 1868) traced to the kea, and I quote a letter from a Mr. J. H. King, who, early in the 'seventies, was employed to shoot the keas:—

"I have seen a flock of twenty or thirty birds attack a mob of sheep in the high precipitous country. The sheep as soon as attacked would huddle together as if driven by dogs; the keas would harass them until one kea would suddenly alight on a sheep's back, holding on to the wool of the rump. The sheep so attacked would immediately single itself from the mob and rush frantically about, and would either go over a bluff or drop down from exhaustion, when the kea which had still held on was joined by several others, and they soon destroyed the sheep."

Mr. King has shot a kea which was on a sheep's back.

It may be noted that the attacks are mostly made at night, hence the rarity of personal observation of these attacks; that they occur in a comparatively limited area, from the region of Mount Cook and the Mackenzie country in South Canterbury to the Takitimu range in Southland, but the centre of the area is round lakes Wanaka, Hawea, and Wakatipu.

Finally, as a comment on the irresponsible statements made at the Wellington Institute, I may quote from the *Otago Daily Times* of February 16, 1906:—"A meeting of landholders at Culverden to-day passed a resolution urging the Government to increase the bonus of 6d. each paid for keas' heads, and asking the county councils of Canterbury affected by the kea nuisance to cooperate with them in petitioning the Government for assistance in reducing the pest. The keas have been very numerous in the mountainous parts of Amuri county during the last two years. They seem to have moved northwards from Otago. . . ."

The report then proceeds to give the experiences of various Canterbury run-holders, which are in all respects similar to those recorded thirty years ago by the Otago men (*vide* Buller's "Birds" and Hutton's "Animals of New Zealand").

There can be no doubt that the keas have wrought, and are still causing, great havoc among sheep in certain districts.

It may be worth noting that the statement frequently made (*vide* Wallace's "Darwinism") that they "go for the kidney-fat" especially is an exaggeration. Those men whom I have interviewed tell me that the kea will eat any part, even the entire carcass, of a sheep, leaving the bones clean; they are not such "gourmets" as has been supposed.

W. B. BENHAM.

Dunedin, February 18.

### A New Product of Actinium.

RECENT work has directed attention to the great similarity in the modes of transformation of actinium and thorium. Thorium, probably itself inactive, gives rise to radio-thorium (Hahn, *Jahrbuch d. Radioact. u. Elektron.*, ii., 3330) which emits  $\alpha$  rays; radio-thorium forms thorium X, which is followed by the other well known products, the emanation and the active deposit. Actinium behaves in a very similar way. By the same method, which was successful in separating thorium X from thorium, Gcdlewski (*Phil. Mag.*, July, 1905) showed that a new